

**U.S. EPA Environmental Technology Verification Program
Advanced Monitoring Systems Center**

Air Stakeholder Committee Meeting

**April 25 and 26, 2002
Pine Mountain, GA**

MEETING MINUTES

ATTENDEES

Stakeholder Committee Members:

Ernest Bouffard, Connecticut Department of Environmental Protection
Jeff Cook, California Air Resources Board
Rudy Eden, South Coast Air Quality Management District
Phil Galvin, New York State Department of Environmental Conservation
Tim Hanley, U.S. EPA/OAQPS
Geri Hart, U.S. Air Force, Tinker Air Force Base
Tom Logan, U.S. EPA/OAQPS
Andy McFarland, Texas A&M University
Will Ollison, American Petroleum Institute
Roy Owens, Owens-Corning
Lindene Patton, Zurich North American
Donald Stedman, University of Denver

Observers:

Mike Fogle, Georgia Department of Natural Resources, Environmental Protection Division
Dave McNeal, U.S. EPA/Region 4
Rocky Moser, Thermo Environmental Industries

EPA/Battelle AMS Center Staff:

Robert Fuerst, EPA/ORD/NERL
Liz Hunike, EPA/ORD/NERL
Gretchen Hund, Battelle
Tom Kelly, Battelle
Karen Riggs, Battelle

Guest Speakers:

John Bosch, U.S. EPA/OAQPS
Eric Edgerton, Atmospheric Research & Analysis, Inc.
Danny France, U.S. EPA/Athens, Georgia Lab
Steve Lingle, U.S. EPA/National Center for Environmental Research
Connie Oldham, U.S. EPA/OAQPS
Susan Zimmer-Dauphine, Georgia Department of Natural Resources

Welcoming, Agenda, and Meeting Objectives

Karen Riggs, the Battelle Project Manager for the ETV Advanced Monitoring System (AMS) Center, welcomed the committee stakeholders and observers and outlined the following objectives for the meeting:

- Update on ETV Program Status
- Update and Input on AMS Center Current Verification Tests
- Understand Local Air Monitoring Activities and Needs
- Consider Process Improvements
- Discuss Homeland Security ETV Opportunities
- Discuss Indoor Air Monitoring ETV Opportunities
- Identify Future Technologies for Verification
- Learn About the National Environmental Technology Challenge (NETC)

Bob Fuerst, the EPA Project Manager for the AMS Center, also thanked the stakeholders for coming and stressed the importance of their feedback in steering the agenda for the Center.

Stakeholder Insights since the Last Meeting

Gretchen Hund asked the full group to report on what their network has to say about ETV and specifically whether ETV's visibility seems to be improving or not.

Phil Galvin mentioned that New York state is very interested in continuous sulfate monitors, trace metals testing, and ambient and source mercury emissions. Emergency response efforts are also of interest to the state.

Rudy Eden reported on a few articles and publications he had seen since the last meeting. He has also referred people to the website on several occasions.

Jeff Cook felt that the results of the fine particulate monitoring verification tests have helped give credibility to and awareness about ETV within Jeff's broad network. Jeff evaluated vendors' websites who participated in the tests and found that they were not misrepresenting ETV (e.g., calling it a certification process). Those vendors whose devices performed well in the test, trumpeted their results while those who did poorly did not mention their results. The vendors Jeff spoke to said that they fully embrace ETV's goals. They did have some suggestions about where improvements could be made: calibration of instruments, reference methods measurements, and training of individuals testing their equipment. It was mentioned that even in tests where training was noted as an issue, when it came time for the vendor representative onsite to test his own instrument, the person struggled and could not make the instrument perform correctly either. There is a possible communication problem between vendor staff in these cases. Jeff felt that the vendor community really understood the importance of getting an ETV verification and that this sense was even understood on the part of some of the user community too. Jeff questioned whether the EPA regional offices really understood the importance of ETV.

Tom Logan reported that the vendor community with whom he communicates is very aware of ETV. The ASTM community and utility sector is even aware. He echoed the comment that state and local regulatory knowledge of ETV was limited.

Tim Hanley reported that the ambient air community was moving slowly towards understanding ETV. Tim refers calls he receives to the ETV website which has been a huge help in expanding the word. Interested individuals can pull up specific verification reports in which they are interested. Tim knows that vendors who participated in the fine particulate test and had positive test results have increased their market share and those vendors who did poorly have pulled their units off the market and reconfigured them to perform better.

Geri Hart mentioned that her state is interested in dioxin; they will be burning contaminated soil (with chlorinated compounds) in an incinerator. She also sees an interest in Homeland Security.

Lindene Patton reported on the huge financial impact her industry has seen since the last meeting in the area of mold insurance claims. There has also been increasing interest in biological warfare detection.

Roy Owens reported that ETV has helped him help plants find devices they need. He gave the example of a portable monitor for a specific plant.

Ernie Bouffard discussed the meeting at EPA Region 1 on verification of ammonia CEMs. Approximately ten vendors, along with several state officials attended the meeting. Ernie reported that June 12 is the NESCAUM meeting in Portland, Maine.

Bob Fuerst mentioned the phone calls he receives about ETV and how it is now viewed as “real”. He discussed the recent piqued interest in Homeland Security at EPA. The Assistant Administrator for the Office of Research and Development at EPA was at a recent meeting and cited the AMS Center as having a potential role. Bob is on a Homeland Security team at RTP. Bob also commented on the direct help the stakeholders’ feedback provides to ETV and thanked the stakeholders for this support.

Tom Kelly reported that he received calls frequently from vendors and is now receiving calls from vendors who want to be re-verified.

Karen Riggs reported that she receives calls as well which she thinks is a good sign. The verification reports on the website help to sell ETV. She discussed how the Ministry of the Environment from Japan has become very interested in ETV and specifically the stakeholder process. This interest was raised following the report from Toru Esaki, Mitsubishi Research Institute, Inc., who attended the previous AMS Center Air Stakeholder Committee meeting in Seattle in October 2001, and reported his findings to the Ministry.

John Bosch reported that ETV has led to some changes in ASTM standards. Specifically he referred to a dust suppression filter media protocol that was adopted by ASTM. John recommended going through ASTM with ETV protocols. He sees the next stage being to have ETV protocols accepted by ISO.

Other speakers and observers then introduced themselves and described their responsibilities.

ETV Program Update, Accomplishments, and Future

Karen Riggs gave the programmatic update on ETV. Some statistics she reported were that:

- 164 technologies have been verified
- 1,147 stakeholders are in 18 groups
- 60 generic protocols and 96 Test/QA plans have been written
- 83 technologies are in the verification process
- Over 100 applications are pending for ETV tests
- \$1.8M from vendors has helped to fund ETV testing.

The goal is to have 50% of test costs covered by the vendors. After participating, the vendors are surveyed to determine their opinions of ETV. These opinions will be part of a report that is being prepared for Congress that describes ETV accomplishments.

Karen reported that Homeland Security is being given much more visibility but it's still new enough that understanding exactly the path ETV will take in support of it is not completely clear. A new program that is being initiated at the Administrator's level is the National Environmental Technology Challenge which the committee will hear about tomorrow from the director, Steve Lingle.

Verification Status

Tom Kelly from Battelle reported on three technology categories.

Multi-Gas Portable Emission Analyzers

Univ. of California at Riverside College of Engineering Center for Environmental Research and Technology (CE-CERT) is the subcontract testing laboratory to Battelle. They will test these analyzers with gas and diesel sources. This test will be similar to the NO/NO₂ tests conducted previously, except the current test will address multiple pollutant capabilities (i.e., SO₂, CO, O₂, as well as NO/NO₂). To date, Testo is the only vendor that has signed up and is scheduled to be tested. The Test/QA plan has been finalized and the test is scheduled for June 10. Other vendors are being prompted to participate as well. It is likely that ultimately there will be three vendors participating. Stakeholder Rudy Eden expressed an interest in observing the test. The question was asked whether other UC institutions could be a subcontractor to Battelle given CE-CERT's approval as a subcontractor. It was unclear whether this would be possible.

On-Board Vehicle Emission Monitors

Clean Air Technology, Inc. is the vendor whose on-board monitor has been tested (May 2001). They have a portable device that samples exhaust and connects to the engine of a vehicle. Reporting was held up because full payment of the verification fee was not received. The company has received funding from the NY State Energy Research and Development Authority (NYSERDA) and it is expected that the company will now be able to pay the fee and the report can be prepared. It is expected that the report will be finalized, reviewed, and approved by

September 2002. The company is interested in having its diesel monitor tested in the future. Stakeholder Don Stedman reported that there are two or three other vendors in the field. Sensors Incorporated in Ann Arbor was mentioned as a possibility. EPA funds this group. Battelle is looking for partners to support a verification test of the diesel emission monitor. Rudy Eden mentioned that SCAQMD has a technology advancement office that funds research in this area. Dr. Chung Yu is the point of contact. Kitleson from Minnesota is another option. CE-CERT has a trailer that can be hooked up to a semi tractor to also test diesel mobile sources. John Bosch mentioned DOD as another possible partner (SERDP statement of need for mobile sources). Finally, EPA-RTP has a similar trailer to CE-CERT and the contact there is Bruce Harrison (EPA/NRMRL).

Multi-Metals Continuous Emissions Monitor (CEM)

Cooper Environmental Services has an X-ray fluorescence-based CEM that was tested at Toole Army Depot. Particulate matter and mercury vapor are collected on filter tape every 20 minutes, and the metals concentrations are measured immediately by XRF. The test occurred at an incinerator used to destroy conventional munitions. The target metals measured were As, Ba, Cd, Cr, Hg, Ni, Pb, Sb, and Zn. All were spiked into the flue gas, except Pb which is native. Cooper's CEM was compared to dual Method 29 trains, in 13 runs over 4 days of operation. The Center for Health Promotion and Preventive Medicine of the U.S. Army in Aberdeen did the reference method measurements. Data were provided on accuracy and precision. The report has been completed and has been both vendor- and peer-reviewed. The report will be submitted for EPA approval in May 2002.

Ambient Monitoring / Air Toxics Program for the Region

Susan Zimmer-Dauphine from Georgia State Department of Natural Resources spoke to the committee about the sophisticated program the state has to conduct ambient monitoring. They have a criteria monitoring network, an ozone network (18 monitors for ground-level ozone), four monitors for NO₂, lead monitors, ten PM₁₀ monitors, 24 PM_{2.5} monitors (three of which are continuous), and five SO₂ monitors. They have a PAMs program and during the summer months they measure for 56 hydrocarbons. They also have an air toxics monitoring network with 19 sites around the state. Thirty-six VOCs, 45 semivolatiles, ten metals, and seven aldehydes are all monitored in this network.

With respect to future needs, Susan reported that they would like better instruments for their PAMs program. They are using field GCs. Other states are using Summa canisters on a 3-hour basis and they would like to be able to compare their results with these. In the air toxics monitoring network, there are also comparability issues because of using different analytical labs. In North Carolina and South Carolina they have a one-year project to split sampling and to build up data. Susan wants to be sure that the regional data are comparable. Susan reported that they would like to have:

- field robust GCs; staff is spending too much time during the summer months trying to keep the sites operational.
- field analyzers to reduce the need to take samples to the laboratory, which is very expensive.

- methods for measuring diesel particulate.
- methods for measuring 80-90 HAPs, some of which could be important; would like a “tricorder” to measure everything.
- weather-proof instruments and self-contained instruments that can operate in remote locations.

Danny France from EPA’s Athens, Georgia laboratory followed Susan’s presentation to describe the ambient air toxics monitoring program for the whole region. Unlike most other EPA regions, Region 4 conducts much of their own laboratory work. Danny complimented Susan by saying that her program is more ambitious than the other states in Region 4. The three categories under air toxics are VOCs, semi-VOCs (including PCBs, pesticides, and dioxins and furans), and metals. A major contributor to this last category is mercury. He mentioned that monitoring is part of remediating Superfund sites, responding to emergencies, conducting compliance studies, conducting risk assessment studies, and tracking the deposition of persistent, bioaccumulative, and toxic chemicals. Danny reported that air toxics monitoring requires expensive lab support and that the methods are trouble prone. For example, semi-VOCs require extreme care in the field to monitor. Large amounts of solvents are needed that are expensive and samples have to be manually extracted. Hexane ether is used and it is recycled. They are looking for an alternative method. They lack the methods to measure many air toxics and often have inadequate detection limits. Excessive costs are a problem, particularly given inadequate funding. Ten times more funding goes to PM_{2.5} than to air toxics and the burden for measuring air toxics has been shifted largely to the states. They also lack air quality standards for ambient concentrations of air toxics.

With respect to technical needs, they would like to have seamless sampling and better analytical methods. Danny acknowledges that they will never have methods for all 188 HAPs, but he would like to see methods for the 33 HAPS that are the highest risk. Currently, methods are established for about half of these. Concerning the National Air Toxics Network, he would like to see proficiency standards and a better job of defining accuracy (precision is currently done well, so this is not a problem). He mentioned that a contractor is working on defining accuracy for the aldehyde method, TO-11a.

Atlanta SuperSite Project (including the Aerosol Research Inhalation Epidemiology Study (ARIES) and the Southeast Aerosol Research and Characterization Study (SEARCH))

Eric Edgerton of Atmospheric Research and Analysis, Inc. provided this presentation. SEARCH was started in June 1998 (with one site being at the Jefferson Street site in Atlanta, GA). ARIES was started in August 1998 and the SuperSite project was started in August 1999. There are eight total sites that are part of SEARCH, with paired sites located in a large city and a nearby rural town, respectively. The goal is to understand the composition of the aerosols and the variability year to year and season to season. The study is to last until 2005. An additional objective is to test and improve PM_{2.5} monitoring methods. They are interested in particles but have to look at gases too. They are struggling to measure ammonia continuously. They have a sulfate instrument and a technique (a modified version of George Allen’s approach) whereby SO₄⁼ is converted to SO₂ with a tube furnace. The Jefferson Street site is paired with a site in

rural Yorkville, GA. At this rural site, they have been able to distinguish emissions from different coal-fired power plants, and the transit time can be measured before the emissions reach the site (e.g., six hours for one plant). They routinely measure 8% black carbon from biomass burning, less than 1% $\text{SO}_4^{=}$, less than 1% NO_3^- , 2% NH_4^+ , and greater than 85% organic matter. Eric discussed logistics for the tour of the Jefferson Street Site facility that he was giving the following day.

David McNeal, an observer from Region 4 in Atlanta, identified some monitoring needs that he felt were important – a reliable continuous emission monitor (CEM) for particulates. He would like to put one in a permit if a good one existed. He acknowledged that EPA doesn't put much investment into this area. Standards are based on mass concentration, not volume concentration.

Mike Fogle, an observer from the State of Georgia Environmental Protection Division within the Department of Natural Resources, echoed the need for CEMs for mass and devices that measure the effects of mass change (a requirement under their regulations). He also felt that devices that measure pinhole leaks would be helpful and detectors for broken bags (in offgas systems) are needed. Other suggestions were pH monitors (intermittent would be adequate), gas flow devices, CO emission monitors, and low NOx analyzers.

Verification Status: Mercury CEMs (Phase 2 Plans)

Tom Kelly from Battelle described the plans for this test. Battelle is collaborating with the Department of Energy (DOE) to conduct the test at Oak Ridge, Tennessee at DOE's TSCA incinerator. DOE is providing much of the funding for the test while ETV is providing the technical support, quality assurance oversight, and assistance in involving and coordinating vendors. The plan is to use the Ontario Hydro (OH) method as the reference method for the test. The test will begin with one week of OH sampling, followed by 1.5 months of routine operation, and then a second week of OH sampling to compare the OH method with the mercury CEMs. There will be dual OH trains to support data reproducibility. A compressed gas standard of elemental mercury will be used daily to assess stability of the instruments. Three vendors have signed up to have their CEMs tested (Nippon, PS Analytical, and Opsis). Two other companies have verbally committed but have yet to send in their fee. June 17 is the installation date for the CEMs. June 24 will be the first week of testing. In August the second testing week will be conducted. DOE will prepare a draft test report. Battelle will prepare separate ETV verification reports for each technology and the appropriate parties will review both reports simultaneously. The final reports will be issued at the same time. Jim Dunn, a contractor for DOE, will be managing the DOE evaluation. Severn Trent Labs will be the analytical lab used. Stakeholders Will Ollison and Roy Owens offered to review the reports.

Verification Status: Ammonia CEMs - Slip Application

Tom Kelly also gave this presentation. He explained that ammonia that goes unreacted and escapes from a NOx reduction system is the target of these CEMs. A vendor meeting was held in Boston in January 2002 with EPA Region 1; 15 people attended including about 10 CEM

vendors. About five vendors would like to see the test conducted at a coal-fired boiler and another five would like to see it at a gas-turbine facility. Currently, the plan is to conduct the test at an American Electric Power coal-fired power plant in West Virginia. The reference method will be EPA's CTM-027 (Method 17 train with IC analysis), which is a wet chemical reference method. The plan is to spike ammonia at the facility during a one-month test period, with multiple reference method samples during that period. The plan is to conduct the test this summer. Battelle is also looking for a candidate gas turbine test site.

Stakeholder Don Stedman recommended using one of the new gas turbine plants that is followed by a gas cycle and reported that 20 such plants have been built in Texas. He saw this as the wave of the future. With the old designed plants, coal is only 40% efficient, but with these new plants they are 60% efficient, according to stakeholder Andy McFarland. Andy offered to forward names of such plants to Battelle. CalPine is one such company.

Retrospective Review of ETV Program / AMS Center (Lessons Learned and Improvements)

The group referred to a write-up that stakeholders Rudy Eden and Jeff Cook developed, and the resulting responses from Battelle. This write-up was discussed to some degree at the previous stakeholder meeting in October 2001, and the purpose of the present discussion was to more fully discuss lessons learned and proposed adjustments.

The group started by discussing the issue of vendors misrepresenting ETV in how they use the verification statement they receive following a test. Vendors have been known to try and advertise their statement as an EPA "approval or certification" of their instrument, which is not the case. Stakeholders suggested that EPA consider first drafting a letter to a company misrepresenting ETV, telling them to cease and desist. If they do not, then pull their verification report and statement from the EPA website. Stakeholders suggested putting language into the vendor contract explaining the consequences of misrepresenting ETV and examples of the types of statements that would be unacceptable. It was recommended that this suggestion be described at the next full ETV meeting to determine EPA's interest in following such an approach.

Stakeholders suggested that concentration range be added to verification statements and that the most critical data (parameters common across devices) be put in a table so comparison among statements is easier. Verification report reviewers could help in suggesting the parameters that should be included in the box for a particular test.

It was suggested that if a stakeholder reviews a verification report and gives his or her signature on it, he or she should be given the opportunity to re-review the report if major concerns were identified. Conversely, if only minor comments are made (and this box is checked), the reviewer does not need to see the report again. If the reviewer rejects a report, then he or she should not be listed or acknowledged as a reviewer of a report.

The question was posed about how to encourage stakeholder involvement in vendor meetings. It was suggested that Battelle call those stakeholders who offered to be involved in a particular test

and to alert them of when the meetings are happening as soon as possible. Furthermore, the relevant stakeholders should be encouraged to come to the actual tests when possible.

The point was made that many of the EPA regional offices are still not familiar enough with ETV. It was suggested that the “Monitor” be sent to all Air Division Directors (EPA and state officials).

One stakeholder suggested that the person who is responsible for testing a particular instrument be adequately trained in how to use the instrument. In some cases, a vendor may blame the tester as the problem in their instrument not performing adequately. This problem may be minimized if the tester has been approved by the vendor who signs some form prior to the test. The point was raised, however, that it’s somewhat irrelevant whether the tester is with the vendor or independent when problems occur, because there have been cases where a vendor representative did not obtain good results with his own instrument.

There was discussion about possible inconsistencies in conducting a second-round test of a particular category of instruments. How does ETV assure comparability if the lab is different for the second-round test? Battelle commented that so far in second-round testing, they have always used the same site and the same people but this could change in the future. The point was made that performance audits would be conducted at each test to help minimize any inconsistencies.

The issue of improving past test protocols before conducting a follow-on test was discussed. It was acknowledged that the tester may want more specificity in a future test than was required initially. The argument was made to first write the test/QA plan and then write the generic verification protocol and incorporate changes from first round testing into the protocol.

It was also mentioned that reference methods could evolve over time. ETV will have to be prepared for this. ETV should stick with using reference methods, not equivalent methods to ensure consistency to the degree possible.

National Monitoring Update for Air: What’s Coming?

Tim Hanley began the discussion focusing on ambient air issues. The EPA Office of Research and Development (ORD) in Las Vegas is ranking method needs and priorities for ambient monitoring in order to develop a strategy for method development. ORD has issued a request to OAQPS to rank methods for implementation. Staff indicated 1 for high priority needs down to a 4 for low priority, and 9 for cases where a priority could not be defined. The continuous monitoring methods that received a 1 were: fine mass, coarse mass (PM₁₀ – 2.5), organic carbon (OC), and elemental carbon (EC). A 2 ranking was assigned to ultra-fine mass, nephelometers as mass monitors, HNO₃, and NH₃. A 3 was given to sulfate, nitrate, and single particle mass spectrometers. And a 4 was assigned to ammonia and trace elements. A 9 was given to other ions. Under physical properties, a 2 was given to size distribution methods, a 3 to density methods, and a 9 to index of refraction methods. Under carbonaceous material, which includes collection and analytical methods, a 1 was given to OC collection methods, OC and EC differentiation in analytical methods, and OE/EC standards and reference materials. A 2 was

given to standards and methods for individual organic compounds. Finally, under chemical speciation – integrated methods, a 1 was given to continued work on comparability of existing networks (IMPROVE, STN, and CASTNET) and coarse mass. A 2 was given to sequential sampler evaluation, efficiency and capacity of denuders, ultra-fine mass, size distributions, and coarse mass composition. ORD will ask other clients in addition to OAQPS so these priorities may be changed by ORD.

Tim's talk was followed by a joint presentation by three people within OAQPS's Emission Measurements Center (EMC), which is focused on source monitoring. Connie Oldham, EMC group leader, began the presentation. She indicated that EMC is the catalyst for development and adoption of source methods. She cited the compliance assurance monitoring rule, which is to replace the enhanced advanced monitoring rule. The former is believed to be more innovative and it is expected to be a catalyst for new technology and monitoring as it is adopted. She cited three areas as emerging in importance:

1. Alternative methods - approval by source category.
2. Open market trading/emission. Statistics will be coupled with monitoring to determine reductions. (As a sidenote, South Coast Air Quality Management District found it could not do this for VOCs).
3. CEMs assessment team where options will be found and incentives developed for superior monitoring.

Connie and Tom Logan gave some examples of innovative projects at EMC. In the area of mercury CEMs, important aspects are:

- Utility MACT rule supportive
- Evaluation of reliability over time
- Determination of durability, setup, and maintenance costs
- Determine elements of a mercury CEM performance specification.

EMC has had some interactions with the Germans to look for innovations, and is currently testing two CEMs that use the dry catalyst approach for mercury speciation.

Future work planned includes longer-term data collection, CEM speciation ability, and other boiler types / fuels / emission controls that might arise.

Tom Logan described a project on digital opacity systems, an alternative to the current Method 9. The Air Force is funding them to use color digital cameras to try and better evaluate opacity from smoke. This approach appears to have improved precision and better resolution over the eye. The hard copies of photos are also more objective than someone's visual estimate, and digital records are retrievable for re-evaluation. They plan to train people in how to use these cameras. Grey, cloudy days are the real challenge with this approach. However, the method can separate out water vapor. They are conducting tests at two sites – Wright Patterson Air Force Base in Dayton OH, and another site in Georgia.

EMC is also focused on a new PM (fine) source test method that should be available in one year. They dilute fluegas 30 to 1 and collect particles in cyclones and on a filter. The method was supported by the National Research Council in their speciation of particles on filters report.

John Bosch described several partnerships EMC has with the DOD. EPA can show that they have saved DOD \$7 million a year by not having to send personnel to normal smoke school to read opacity. This figure may rise by an order of magnitude as the digital opacity systems are used more. Another area of partnership is on multi-metals CEMs that may be used at DOD demilitarization furnaces. A new PS 10 has been developed for such CEMs. EMC also is involved in a firing point study for firing ranges where they characterize the dynamic plume from the range and measure HAP emissions. Another partnership is on measuring jet resonance enhanced multi photon ionization (REMPI) / HAP emission factors (dioxins and furans). Another joint focus is on remote optical sensing for open sources (with the Air Force) where the focus is on emission fluxes from tanks, lagoons, and landfills. Another focus is open burning and detonation monitoring where EMC is looking at 3-D measurement of HAP emissions fluxes. EMC is serving on a Board of Directors for DOD's Ammunition Disposal Research Programs. Finally, joint work is evaluating laser spectrometer CEMs that are portable monitors for HAP metals. DOD SERDP funding focused on welding, cutting, and plating operations is supporting this effort.

Homeland Security Air Monitoring

Matt Shaw, from Battelle, described the needs and current technologies in this area. The current situation is that chemical and biological security monies are being put towards purchasing proven (fielded) technologies for rapid deployment. Operational costs are large, R&D investments are skyrocketing, and unproven technologies are being more and more purchased. The applications of interest are surveillance (detect to warn, detect to treat), incident assessment, and decontamination. Matt summarized the basic classes of chemical agents with respect to their effect on humans: choking, blood agents, blister agents, and nerve agents. They all vary greatly in their state, level of toxicity, mode of action, speed of action, and persistence. In contrast, biological agents are living microorganisms or toxins derived from biological entities that cause death or incapacitating diseases. Classes of biological agents are bacteria, viruses, fungi, rickettsiae, and toxins. The routes of entry for these are oral, inhalation (vapor or aerosol), percutaneous (direct injection like gangrene bombs), or dermal (e.g., hand lotion). It generally takes much less of a biological agent than a chemical agent to be a lethal dose.

Detection technologies can be divided into two categories: point sensors and stand-off sensors. The former measures for the agent in the immediate vicinity. The latter are optical remote sensing techniques to detect the presence of agents from 1 to 5 kilometers away. They are used to provide an early warning. There are numerous categories of chemical agent point sensors (e.g., ion mobility spectrometry, flame photometry, flame ionization). Biological agents are measured using separate devices (sometimes in an integrated system): a sampler trigger, collector, and detector or identifier. Matt described some of the categories of technologies under each of these areas. He cautioned the audience in thinking that there are robust systems that are "proven" and reliable. Commercial detectors for chemical agents are available; commercial detectors for biological agents are not viable at this time.

Matt then described the type of testing he would recommend be followed if ETV decides to embark on verifying technologies in this area. He recommended measuring sensitivity, selectivity, response time, and false alarm rate. Important test parameters are challenge concentrations (quantity, how quickly the agent showed up (delivery profile)), challenge properties (composition, size distribution), and background (level, variability, composition, and size distribution), and environment (wind speed, direction, temperature, humidity). Testing options include an aerosol wind tunnel testing unit, a containment box approach (like the previous but in a box), or an ambient breeze tunnel.

Matt saw the need for standardized testing of devices in this area increasing dramatically which is very positive for the end-user community. There are limited state-of-the-art facilities to conduct these tests.

Stakeholder Don Stedman followed Matt to give some of his impressions. He referred to a National Institute of Justice report called “An Introduction to Biological Agent Detection Equipment for Emergency First Responders,” 101-00, Dec. 2001, 44pp as a good reference. You can download it via <http://www.ncirs.org/pdffiles1/nij/190747.pdf>. Another reference he gave was <http://www.ncirs.org/pdffiles1/nij/184449.pdf> and the same but 184450.pdf. “Chemical Agent Detection and Toxic Industrial Material” is this report. There are many claims by vendors that could be well tested by ETV but you would have to pick the component that would be testable. Stakeholder Andy McFarland recommended against testing detectors. There is a problem with taking aerosols to a liquid or plating them. Where ETV could play a role is in the front end of the process – samplers and how well they work at delivering the air sample to an identifier or depositing the sample on Agar. This area would be doable. The devices in this area are well established and reproducible.

DAY 2 –April 26

National Environmental Technology Challenge (NETC)

Steve Lingle, from EPA/ORD National Center of Environmental Research (NCER) described this new program that is being launched in coordination with EPA/ORD National Risk Management Research Laboratory. There is an anticipated \$10 million in EPA’s 2003 budget for NETC. Steve described its mission as a private/public partnership to improve the environment through innovative technology. The Administrator requested the initiative. Its two goals are:

1. to identify and award innovative technology that produces effective and lower cost solutions to environmental problems, and
2. to stimulate private investment.

NETC’s approach is to:

1. identify problems, prioritize gaps,
2. develop performance requirements and selection criteria,
3. conduct national competition,

4. have external panels review solutions,
5. give honorary / monetary awards (Presidential Award for Environmental Technology Innovation), and
6. support technology adoption.

They are interested in creating markets where possible. Steve used an example to describe their plans – quantifying ozone precursors would be the topic. They would make a call for technologies that have the ability to quantify smog precursors to support market-based trading (as one possible target). The technologies would need to address VOCs, NO_x, PM₁₀, and PM_{2.5}. They would need to quantify how they would address both point sources and fugitive sources. Possible criteria for evaluating technologies could be reliability, accuracy, and cost. They would make the call for the technologies in 2003, select technologies in 2004 and 2005. Currently, the Administrator is interested in smog, greenhouse gas emissions, water quality, and municipal water infrastructure. They may have workshops around these four areas.

Steve stressed the need to link with ETV and build on the success of ETV (a 7-year program). He expressed an interest in possibly leveraging the 18 stakeholder groups that are part of ETV to help NETC prioritize technology categories and to design test protocols.

Steve listed the following design and implementation issues that he plans to address:

- Technology priorities
- Technology evaluation criteria (ETV link)
- One or many “winners”
- Use of monetary awards
- Partnerships

ETV stakeholder group issues include:

- Role of ETV protocols in setting NETC performance criteria
- Protocols relevant to the major topic areas of interest
- Increased demands on ETV Centers
- Concerns about a NETC/ETV link

It's not clear whether international companies would be allowed to participate in NETC. Steve sees NETC as a competition where they will put out a solicitation, specify performance requirements, design technology review panels that are outside of EPA to serve as the peer reviewers, have the panels determine whether the technology under review meets or exceeds the criteria developed, but not have them determine winners and losers. There would be a National Awards Board that would cover a broad range of topics and insulate EPA from making the decision.

The ETV stakeholders raised several concerns with NETC including duplicating ETV's mission in verifying technologies. Several stakeholders offered to serve as consultants to Steve in helping him design NETC.

Indoor Air Monitoring – Mold and Chemical Detection

Don Cortes from Air Quality Sciences provided this presentation as a follow-on to a presentation that stakeholder Lindene Patton gave at the previous stakeholder committee meeting in Seattle in October 2001. The committee was interested in learning more about this topic to determine whether there is any niche that may be ripe for ETV to play a role.

Don first described methods that are used to measure chemicals in indoor air. Thermal desorption GC / mass spectrometers to measure VOCs (total and individual) is critical. Aldehydes are potent irritants to people and HPLC is used to measure aldehydes. When warranted, indoor air is also monitored for semi-VOCs, particles, ozone, and comfort parameters.

Concerning VOCs, Don can identify 70 different ones, but those of greatest interest in indoor air are typically phenol, cresols, and 1,4-dichlorobenzene. Detection limit needs to be in the 0.5 to 5 ppb level.

Indoor air problems can mean removing floor covering and porous material but often complete abatement is not feasible. Important criteria to use in evaluating an indoor air monitoring device are:

- Selectivity
- Range of analytes
- Detection limit
- Accuracy
- Sensitivity
- Calibration range
- Stability
- Response time
- Reliability

Don described some example devices that are available on the market. Bruel and Kjer have a photoacoustic gas analyzer that detects a wide range of chemicals (the types depend on the filter used with it). It is advertised to have ppb range detection limits, depending on the gas. Don felt that the ppbRAE is the most sensitive handheld VOC monitor in the world, but it only measures total VOCs. PureTrac Systems makes electronic noses. Purechoice Inc. sends out an email alert if its continuous measuring system picks up something abnormal. There are devices that know to bring in more outdoor air indoors when total VOCs rise. E-noses are interesting and you can refer to www.alphamos.com which describe them. Cyrano Sciences, Alpha MOS, and JPL are examples of companies that make e-noses. JPL's device uses a multi-array that measures in the ppm region.

Measuring microbes is a much greater challenge. The types of analysis typically used are cultures (takes up to 7 days), direct examination, and PCR. Microbes are sampled via the air, surface/bulk analysis, and dust. Chemicals (VOCs) being off-gassed from mold can help in detecting them. Ergosterol is measured using GC analysis but only the presence of it is reported, not the species. Mycotoxins are produced by mold; the microbes emit CO₂ and it is possible to

cover a carpet and measure CO₂ being emitted. A website that might be of interest is www.mycotec.dk/principle.htm

Biological sensing techniques are PCR using micro arrays and cytotoxicity which measures cell death. Important characteristics of a sensing device are:

- Detection and identification of a wide range of chemicals/ microbial species
- Low detection limit
- Immediacy of result
- Experience and reason, which are indispensable in solving a problem

Sulfur and amines are important as well in contributing to indoor air quality problems.

Discussion of Status and Future Technology Categories

Tom Kelly began the discussion by summarizing the technology categories that are currently in the queue to be verified. After this overview, Gretchen Hund facilitated the discussion on other technology categories the AMS Center may want to consider. It was recognized that several of the categories recommended for verification at previous stakeholder committee meetings were still on the list. Part of the intent of the discussion was to revisit these categories to determine whether they are all still of high importance and to consider other categories.

This list includes:

1. **Stack organic speciation analyzers.** Stakeholders Roy Owens, Ernie Bouffard, and Cliff Glowacki were suggested to work with vendors to determine their interest.
2. **Continuous formaldehyde monitors for sources** (which could be combined with #1 in a call for interest from vendors). Agreed to hold off on this technology category.
3. **Nephelometers.** They are seen as a low-cost surrogate for measuring PM. Stakeholder Tim Hanley mentioned that they may be of particular interest given the impending issue with coarse PM which they should be able to measure well. A test could be devised where they measure both coarse and fine. Tim indicated that a test of nephelometers would be very important because a low-cost surrogate to PM is needed. NESCAUM is very interested in nephelometers. AQI and NESCAUM could be incentive for nephelometer vendors.
4. **Ambient PM monitors.** It was agreed that a date needs to be established for the next round of ambient PM testing so that vendors can plan for it. Nephelometers (#3) would be part of this call. Stakeholder Tim Hanley is interested in participating in this effort. Tim said nephelometers are a step below OAQPS' top priorities which are coarse and fine particulate.

There was a discussion about whether the follow-on ambient PM verification study should include speciation. On one hand speciation is expensive to conduct (three times as much as measuring for mass), but on the other hand, the greatest improvements in technology design since the last test have occurred in speciation. Stakeholders recommended inviting vendors with technologies for coarse mass and species. They also suggested targeting Summer 2003 for a next test.

5. **Homeland Security monitors** (of major interest, but need to pick categories that are feasible for a verification test).
6. **Handheld VOC monitors**. They could be used in the chemical and biological agent detection area (indoor and possibly outdoor) and for more general indoor air use. Absorbant tubes would be one example of devices in this category. It was felt that devices need to be portable, reliable, real-time and usable in the field. Target contaminants are aromatic hydrocarbons and phenols down to 1-5 ppb that can be measured in one minute.
7. **Open-path source monitors (including formaldehyde / VOCs)**. Connie Oldham from OAQPS offered to have this on her agenda for an upcoming meeting.
8. **Mercury CEMs appropriate for power plants**. It was felt that the plant being used for the ammonia slip test may be open to mercury CEMs afterwards.
9. **Ammonia CEMs tested on gas turbines**. Information on possible gas turbine sites in Texas was to be forwarded to ETV staff by Andy McFarland.
10. **PM fine from combustion sources**. Stakeholders Ernie Bouffard and Phil Galvin offered to check with possible interested vendors. It was also recommended that the AMS Center put out a preliminary notice and set a general date for a verification test.
11. **Gas cylinder stability**. Stakeholder Rudy Eden suggested determining whether vendors would be interested in participating in a test. Connie Oldham mentioned that EMC is trying to get a government audit program going again. Tim Hanley suggested that a test of gas cylinders couldn't be done but that dilution apparatus could be verified. Tom Kelly and Stakeholder Rudy Eden suggested ETV verification of dilution devices may not be feasible; too many compounds to test.

Closing

Gretchen Hund and Karen Riggs thanked all of the stakeholders and observers for attending the meeting and contributing so much to the program. Those stakeholders planning to tour the air monitoring site in Atlanta following the meeting were given directions. The meeting finished at 12:00 noon and the committee agreed to re-convene next in southern California on January 30 and 31, 2003.